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WETLAND WONDERS FIELD EXPERIENCE PROGRAM:

BEAR RIVER MIGRATORY BIRD REFUGE

by

Kristen Gilbert

A paper submitted in partial fulfillment of
the requirements for the degree

of

MASTERS OF SCIENCE

in

Range Science

Approved:

Utah State University
Forestry, Range, and Wildlife Sciences Department
Logan, Utah

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ABSTRACT

The Wetland Wonders Education Program: Bear River Migratory Bird Refuge

by

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Utah State University, 2002

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Wetland Wonders Field Experience Program(WWFEP) at the Bear River Migratory Bird Refuge connects U.S. Fish and Wildlife Service conservation and education goals with an educational need (understanding wetlands) in the Great Salt Lake Ecosystem by using innovative education and volunteer initiatives. The WWFEP has two principal components, the Education Program Module (EPM) and the Volunteer Instructor Module (VIM).

The EPM provides a well rounded environmental educational experience to third, fourth and fifth grade students based on constructivism, inquiry-based learning, subject integration and a theoretical model of environmental education. Third graders study *Wetland Creatures* (adaptations and habitats), fourth graders study the *Wetland Ecosystem* (abiotic and biotic relationships), and fifth graders study the *Great Salt Lake Watershed* (wetland function, threats, and management). The EPM is divided into three lesson components: the pre-field, field, and post field. The pre-field component includes the use of student directed learning centers (discovery drawers) in the classroom to

engage and teach students about the refuge, reducing the need for teacher-driven pre-site lessons. The field component is a 4- hour, station centered visit to the refuge where students acquire knowledge and awareness about wetlands through hands-on activities. The post-field component consists of a 1-hour classroom visit that unites the entire experience by reviewing field content and applying learning to a relevant wetland conservation problem.

The VIM provides a protocol for recruiting and training parents and community members to teach the field component of the program, which reduces refuge planning and staffing pressures. The WWFEP was field-tested in spring 2002 at two elementary schools in the Box Elder School District. Teacher, students, and volunteers were formally and informally evaluated. Overall, evaluations indicated that the EPM and VIM were well organized and well received. Evaluation comments noting deficiencies in content and/or structure were used to improve the final version of the WWFEP.

Introduction

The Wetland Wonders Field Experience Program (WWFEP) connects U.S. Fish and Wildlife Service (USFWS) conservation and education goals with an education need in the Great Salt Lake Ecosystem using innovative education and volunteer initiatives. Human threats to the Great Salt Lake Ecosystem and the Bear River Migratory Bird Refuge (BRMBR) create a need for public awareness and understanding of agency conservation objectives. Also, Utah schools have a need for supplemental environmental expertise to achieve state education standards. The refuge has this expertise, and it is a perfect, natural education site. Staffing and funding shortfalls have prevented the refuge from taking advantage of this education potential. The WWFEP partners community members, schools, and the BRMBR to provide a quality environmental education program accommodating the conservation and educational needs of the community without stressing refuge resources.

Bear River Migratory Bird Refuge

A 1928 Presidential Proclamation established the BRMBR to provide “feeding, breeding and resting habitat for migratory birds” (23). The BRMBR, like other federal lands, is also charged with protecting historical and cultural artifacts and providing public access (23). The BRMBR employs a number of management tools to fulfill its goals: water and plant manipulation, habitat restoration, research, population monitoring and public relations.

The BRMBR is found at the Bear River delta on the northeast arm of the internationally recognized Great Salt Lake (GSL). The 70,000 acre BRMBR comprises one of over 535 U.S. National Wildlife Refuges in the United States. The BRMBR’s myriad of habitats --grasslands, freshwater emergent wetlands, alkaline mud flats, open water-- provide resting habitat for over 226 bird species and nesting habitat for over 60 bird species (23).

Two major development issues threaten the GSL and BRMBR: water development and suburban expansion. Refuge dikes and ponds form the network of wetland habitats, and currently, managers judiciously and efficiently distribute water to as many acres as flow permits. Because of upstream water use, low water years result in

most refuge habitat being dry. Bear River water development continues to stretch the refuge's ability to accommodate seasonal flow fluctuations and still provide feeding, breeding and resting habitat for birds. Suburban development in Box Elder County also threatens the integrity of nesting habitat on the eastern border of the refuge. Current residential and agricultural development has increased nest predator populations (raccoons, foxes and skunks), and proposed commercial developments will destroy nesting habitat on private property bordering the refuge.

A public aware of refuge conservation objectives is more likely to champion these objectives in times of controversy. Through public awareness programs, the refuge encourages public support for refuge conservation objectives. The Migratory Bird Day Banner Contest encourages local school children to learn more about the migratory birds who visit the BRMBR, and the Bear River Bird Festival provides an opportunity for the public to interact with refuge staff and local conservation groups. The WWFEP will extend public awareness at the refuge through a two-fold education program. Student awareness will be sparked through the field trip, while adult participation (teachers, parents, volunteers) will provide larger community awareness.

The WWFEP fulfills USFWS environmental education policies as well. In 1998, President Clinton signed the National Wildlife Refuge System Volunteer and Community Partnership Act, guiding National Wildlife Refuges "to develop refuge education programs to further the mission of the National Wildlife Refuge System (NWRS) and the purposes of (individual) refuges" (26). Since then the USFWS has drafted environmental education policies, encouraging refuges to develop specific educational programming. The WWFEP initiates these environmental education policies at BRMBR.

The WWFEP follows environmental education policies and definitions outlined in the USFWS Manual, Environmental Education Part 131 FW 1, Policies and Responsibilities and Program Development (27). The WWFEP fulfills the Field Station Standard Level of Activity, which entails:

- (a) Conducting teacher training that focuses on ecological concepts and educational field strategies. Workshops should offer educators' opportunities to practice hands-on activities to be used with students and present an occasion for them to become acquainted with the facility—a tool for increased and improved use of the site by school groups.

(b) Development of site-specific or issue specific environmental education materials. These materials will promote the use of environmental education as a means of solving resource management problems (27).

The WWFEP addresses staffing shortfalls by incorporating a volunteer recruitment and training program. The NWRS is understaffed and under funded (16). Teacher and volunteer supported programs help alleviate funding and staff shortfalls. The WWFEP incorporates elements of innovative volunteer education programs like The Don Edwards San Francisco Bay National Wildlife Refuge Wetland Round-Up Field Program (24), minimizing refuge staff involvement. The Wetland Round-Up Field Program trains teachers and volunteers in a 3½ -hour session to teach a refuge based-education program to elementary school students. One refuge staff person conducts the training and oversees the program implementation.

Don Edwards National Wildlife Refuge is at the northern end of the San Francisco Bay in the heart of Silicon Valley. These intertidal and freshwater marshes, as a resource, have striking parallels to the BRMBR, yet the populations served by these two refuges have few similarities. Both refuges are important to many species of shorebirds and both refuges have similar alkaline and freshwater habitats. Millions of people surround Don Edwards NWR, whereas, the population surrounding BRMBR is significantly smaller. California teachers are also searching for environmental education (EE) sites and programs to fulfill California EE standards, whereas, Utah has no EE standards and teachers have little funding to go on field trips. The WWFEP tests an innovative volunteer program in a significantly different demographic area in order to minimize refuge staff involvement in education programming.

Next year, 2003, marks the centennial of the NWRS and the 75th anniversary of the BRMBR. The WWFEP will celebrate these milestones by heightening local and national interest in the BRMBR as a demonstration site for centennial events. The BRMBR is also in the process of building new education and public use facilities. Currently, no education programming is planned. The WWFEP is a start-up program for these new facilities.

Elementary Schools of the Great Salt Lake Ecosystem

Eighty percent of Utah's population lives within 50 miles of the BRMBR, creating an accessible field trip site for many Utah schools. In the past 5 years, the refuge has turned away 50% of educational requests because of a lack of program structure and administrative support (25). The WWFEP structure and organizational support fill an education gap in the community.

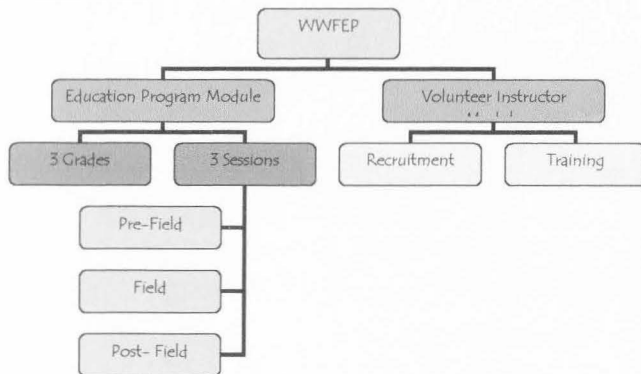
Burgeoning class sizes, budget cuts and increasing emphasis on standardized testing divert teachers from thinking about new learning opportunities such as outdoor field trips. The WWFEP relieves some of the logistical, financial and educational burdens of conducting meaningful student field experiences. Field trip funding is often the first thing to be found on the cutting floor of most schools. In Box Elder County, teachers are allowed one bus field trip per year. The WWFEP attempts to pursue funding for buses. Elementary school teachers are required (through the core curriculum) to supply a higher level of expertise about natural systems. The typical teacher does not have this specific expertise or the strategies to share it (21). The WWFEP offers a cohesive unit based on natural system knowledge described in the Utah State Core Curriculum.

As a two-pronged public awareness campaign, the WWFEP introduces public sentiment to the conservation of the critically important GSL wetlands. The WWFEP connects the objectives of Utah Schools to the conservation and education objectives of the BRMBR while accommodating the challenges and constraints of its involved partners.

Program Design

The goal of the WWFEP is to help students, teachers, and volunteer instructors become aware, knowledgeable, skilled, and invested in the BRMBR and its conservation. To accomplish this goal, the WWFEP was designed as two modules, the Education Program Module (EPM) and the Volunteer Instructor Module (VIM). Both modules were developed and tested concurrently in the spring of 2002. The EPM is a refuge field trip experience for third, fourth and fifth grade students. The VIM is a volunteer recruitment and training program to teach the field portion of the WWFEP (see Figure 1).

Figure 1. Organizational Diagram of the Wetland Wonders Field Experience program and associated modules



In addition to current education research and human resource training and development, two USFWS programs informed the design of the WWFEP. Don Edwards National Wildlife Refuge has been using innovative volunteer recruitment and management techniques to run education programs. Some of these techniques were incorporated into the VIM (24). The second USFWS education program, informing this project design, was the Region Six Rhythms of the Refuge (28, 29), a guide to help refuge field stations develop environmental education programming. The Rhythms of the Refuge materials were informative in developing a BRMBR specific education program consistent with USFWS environmental education objectives and policies. The Program also offered an informative design process. Unfortunately, this process was not available until midway through this project. The design process outlined by the Rhythms of the Refuge Manual(28) includes:

- Step One: Gathering essential background information through a refuge staff workshop,
- Step Two: Developing a program with partners in the community,
- Step Three: Implement the program- workshop and field trips,

- Step Four: Evaluate and modify the program .

The design of the WWFEP for the BRMBR included elements of all these steps. Essential information was not gathered in a formal refuge workshop, but rather informal interviews with various staff members. The WWFEP used teachers, parents, volunteer groups, and USU collaborators as community partners. The program was implemented (trainings and field experiences) and evaluated.

The Education Program Module

The EPM used tested education theories, partner objectives and partner needs to develop a well-rounded field experience for third, fourth and fifth grade elementary school students. Tested education philosophies and strategies guided the development of the EPM: constructivism, inquiry-based learning, subject integration, and a theoretical model for EE.

Constructivist philosophy and an associated teaching strategy, inquiry-based learning are foundation concepts of the EPM. Inquiry-based learning, or learning by discovery, relies on two premises: questions and problems precede answers and students must be actively involved in their learning (1, 11). Constructivist philosophy posits that students are not empty slates on which a teacher scribes knowledge; rather, students are rich with prior experience and the teacher uses those experiences to teach new concepts and skills (18). Questioning sequences, exploration and assessing students' prior knowledge are all major elements of the EPM. For example, when third grade students explore the concept of habitat, they explore their personal needs (food, water, shelter and space) as a platform to transfer the concept to other organisms.

Subject integration is another theoretical construct of the EPM. "Research shows when science is integrated with other subjects around a central theme, like wetlands, the other subjects are learned more effectively (1)." The world is not compartmentalized into neat subject areas. Instead, it is a rich tapestry of interwoven threads. Basing school on the real world makes for a richer learning experience. The EPM weaves art, language

arts, science and history together under the theme of wetlands, creating a cohesive and relevant learning experience.

The social health of the future is as important as the ecological health of the planet they will inhabit. By using an environmental education model, the EPM emphasizes both the importance of ecological literacy and child social and cognitive development. The model follows a learning progression from perceptual awareness to knowledge to cultivation of an environmental ethic to application, by emphasizing process skills and creative problem solving (5). This non-hierarchical model values each level equally, although some levels are not developmentally appropriate for younger children (20). For instance, perceptual awareness is a major emphasis for grades kindergarten through second grade, and knowledge acquisition is a minor emphasis.

The perceptual awareness level of the model seeks to give students an emotional (affective) connection to the natural world through sensory awareness and personal reflection. The EPM incorporates a guided solo/reflection component to the field experience to allow students the time to gain awareness of their natural environment.

Knowledge of the natural world is the second level of the model. Understanding nature's connections, cycles and rhythms gives students an informed background to guide perceptions about their part in the natural world. The majority of the EPM is devoted to acquisition and synthesis of wetland knowledge. This focus stems from State Core Curriculums focus on knowledge driven objectives, as well as the fact that these objectives are the easier to teach and assess in the short program time frame. As knowledge and awareness of the natural world expand, an environmental ethic, the third level, can be fostered. The EPM uses questioning strategies and emphasizes the ecological importance of human and natural events to alert students to personal wetland connections.

Action, the last level, applies new knowledge and skills to conservation problems relevant to the student's life and community. The EPM focuses the action into the post-field visit where students synthesize field trip knowledge in response to a relevant conservation problem, and draft strategies to solve the problem. Cultivation and continued practice of all portions of the model lead to environmental literacy.

Program Topics & Goals

The EPM correlates partner (BRMBR and Great Salt Lake Ecosystem schools) topics and themes to produce a relevant and useable education program. Interviews with refuge staff and reviews of enabling documents and USFWS policies produced a list of general refuge topics. Education providers in the GSLE researched various stakeholders in the ecosystem and compiled a list of wetland education themes (17). These Northern Utah Wetland Partnership themes reflect ecosystem-wide education efforts, and were also included in the topic grid. The Utah Core Curriculum (30) outlines topics and learning outcomes for all elementary grades. Science and social studies topics/standards for third through fifth grades are listed next to GSLE, USFWS and BRMBR topics and management objectives. With the three sets of themes and topics, a correlation grid was created (Table 1).

The grid provided a template to choose common topics for the EPM. The umbrella topic for the three programs became *Wetlands*. The main topic for third grade became *Wetland Creatures*, subtopics were adaptations and habitats. Fourth grade's main topic became *The Wetland Ecosystem*, subtopics were abiotic and biotic relationships. Fifth grade's main topic became *The Great Salt Lake Watershed*, subtopics were wetland function, threats and management. Each grade's topics, independent of the other grades, have the ability to build thematically as a child progresses through each grade.

Table 1. 2002 (old) Utah Core Curriculum (science and social studies topics) for third through fifth grades, and their relevance to GSLE, USFWS, and BRMBR conservation and management topics.

Theme/Topic Sources	3rd Grade	4th Grade	5th Grade
Utah State Science Core Curriculum	<ul style="list-style-type: none"> habitat adaptations Influence of people on ecosystems Geologic features 	<ul style="list-style-type: none"> Utah plant and animal life Water (water cycle) Utah rocks and minerals Utah soils weather 	<ul style="list-style-type: none"> Physical features of the earth over time NR conservation practices & water management Physical changes and chemical reactions
Utah State Social Science Core Curriculum	<ul style="list-style-type: none"> Environment and indigenous communities Map skills Natural resources of various environments 	<ul style="list-style-type: none"> Change in Utah over time Market economics Good citizenship Geographical tools 	<ul style="list-style-type: none"> New world and the US government Constitution and laws How physical features affected expansion
GSLE Wetlands Education Plan	<ul style="list-style-type: none"> GSLE wetlands are important feature of state Important migratory flyway Experience is the best way to cultivate appreciation Effects of humans on wetlands 	<ul style="list-style-type: none"> Definition of wetlands Wetlands are valuable to people Wetland functions Effects of humans on wetlands 	<ul style="list-style-type: none"> Utahns perceptions of wetlands Effects of humans on wetlands Laws of wetlands Private conservation of wetlands Planning for wetlands Watershed of GSL
USFWS National Wildlife Refuge System BRMBR	<ul style="list-style-type: none"> Wildlife comes first anchors for biodiversity Sustain diverse wildlife and plants Provide feeding breeding and resting habitat for native migratory birds Endangered species protection 	<ul style="list-style-type: none"> Healthy wildlife habitats Tools of management Maintain diverse habitats Monitoring habitat 	<ul style="list-style-type: none"> Wildlife management leaders Models of land management Demonstrate innovative models of land management Land acquisition Recreation opportunities Threats to wetlands

Program goals span the five levels of the EE model, but are specific to BRMBR and reflect process skills elementary students are developing at this stage.

EPM Awareness Goal: To develop the ability to perceive and discriminate among stimuli; to process, refine, and extend those perceptions; and to acquire aesthetic sensitivity to the natural world (5). Achievement of this goal will be measured by the following objectives:

- Students will be able to point out five new objects they discovered using their five senses.
- Students will be able to describe in a written or drawn form, their feelings toward wetlands.

EPM Knowledge Goal: To help students acquire a basic understanding of how wetland systems (BRMBR) function, how their functioning is affected by human activity, and how human activity can be in harmony with wetland systems(5).

Achievement of this goal will be measured by the following objectives:

- Students will be able to define at least two ecological concepts related to their wetland field experience (habitat, adaptation, ecosystem, watershed, etc)
- Students will be able to correctly identify at least six wetland organisms (plants or animals)
- Students will be able to verbally describe one human influence on the BRMBR.

EPM Conservation Ethic Goal: To help students develop an ethic on which they may act to conserve the BRMBR (5). Achievement of this goal will be measured by the following objectives:

- Students will observe stated field trip rules related to littering, collecting specimens, and respect for other living things.
- Students will be able to list one personal connection to the BRMBR.

EPM Action Goal: To help students develop the skills needed to identify, investigate, and take action toward conserving the BRMBR and other natural systems. (5) Achievement of this goal will be measured by the following objectives:

- Students will be able to describe a solution to a BRMBR conservation problem, and possible negative and positive effects of their solution.
- Students will be able to describe a process with which to address environmental problems.

With topics drafted and goals and objectives developed, each grade level was assigned a skill level based on developmental ability and student learning objectives. Third graders became Wetland Spies, focusing on observation, categorizing objects, investigating questions and making predictions. In fourth grade, as Wetland Investigators, making inferences, conducting experiments and modeling skills were added. In fifth grade, as Wetland Experts, students form hypotheses as well. The EPM created a developmentally appropriate skill and conceptual progression. This progression also

correlated themes to scale up on an ecological level from creatures to watersheds, emphasizing the importance of connections in an organizational context.

Program Structure

The structure of the EPM blends partner (refuge, schools, volunteers) assets to address partner constraints, producing a quality learning experience for students. The refuge offers resource expertise, an exceptional field site and organizational means to implement an education program, but the refuge lacks an extensive public use staff. Typically, the refuge employs one full-time Outdoor Recreation Planner, with education being only a part of his or her duties. Schools contribute class time and teacher/parent support, but lack time to prepare meaningful field lessons. Volunteers have a willingness to contribute time to training and teaching, yet they have variable levels of pedagogical and refuge conservation expertise.

To take advantage of partner assets and mitigate constraints, the EPM is divided into three components: the pre-field, the field, and the post-field. Research demonstrates that longer EE exposure is more likely to positively affect environmental behavior (32). Pre-, field and post- elements of the EPM lengthen student exposure to refuge conservation objectives increasing the likelihood of instilling environmental literacy and stewardship. Each component accommodates the learning environment (indoor/outdoor), the prospective lesson instructors (refuge staff, volunteers, teachers), and works toward accomplishing certain EPM goals.

The goal of the EPM pre-field component (introduction and discovery drawers) is to prepare and build anticipation for a refuge field experience as well as introduce all four EPM goals and associated objectives (19). Concepts and skills through engaging, fun

activities, allowing students to make the most of the short field experience. The pre-site component consists of two classroom sessions. The first session is an hour-long refuge introduction by refuge staff. Through lecture/discussion and cooperative learning, students learn about the BRMBR. In cooperative learning groups, students explore the history, structure, resources and management of the BRMBR and use presentation skills to present their discoveries to the entire class (See Appendix D).

Also in this first session, the instructor introduces the second pre-site session, the Wetland Wonders Discovery Drawers. These learning stations, sometimes called learning centers or interest centers, are self-contained areas of modules of instructions designed for independent activity on the part of the student. The station may be used to: (1) present new material, (2) reinforce previously learned material, (3) develop a skill, (4) review information, or (5) develop other interests and creativity (22).

Very popular in the 1970's, learning centers were a means for teachers to incorporate a variety of learning techniques in the classroom (14, 2, 22). They are still widely used and emphasized by teacher training programs (33). Environmental education centers like Shavers Creek Environmental Center (University Park, PA) and Teton Science School (Kelly, WY) also employ learning centers, on-site and as an outreach technique (20, 34).

The EPM uses the discovery drawer/learning center concept to address a teacher need and incorporate program education theories into the refuge education program. Often, an environmental education provider, like a nature center, offers in-class, pre-site activities for teachers to implement. Unfortunately, pre-site activities are not consistently

implemented, and students visit a site with little or no preparation. The day turns into an expensive recess versus a valuable learning experience (19).

The discovery drawers are five student-driven learning centers designed to prepare and interest students in a field trip to the BRMBR. The learning centers require organizational support from the teachers but relieve the burden of preparation and teaching. As Wetland Spies/Investigators/Experts, students play various roles or use different skill sets. These roles or skill sets organized the discovery drawers into five roles: artist, explorer, steward, scientist and communicator. Each drawer has a series of inquiry and exploratory activities, allowing students to practice each skill set. All three grades maintain the same roles, but activities vary depending on age level and program topic areas. (See Appendix D)

A 4-hour station-centered visit to the BRMBR comprises the field experience component of the EPM. The field experience addresses EPM knowledge and awareness objectives. Through hands-on activities, students acquire knowledge and awareness about wetland creatures, ecosystems and management.

A field day begins with a short student meeting at the school for review and field preparation. Participants gather in an open area (gym). The Refuge Field Experience Coordinator uses a questioning sequence and student costumes to review the roles of a Wetland Spy/Investigator/Expert to insure everyone is physically and conceptually prepared. A bus ride scavenger hunt focuses student attention on the interesting environment outside, initiating an exciting learning environment early in the day. Upon arrival at the refuge, students have a 10-minute rest break. Students gather under the pavilion for a 20-minute introduction to the day's theme and schedule. The Refuge Field

experience Coordinator facilitates the introduction at the refuge pavilion. Like all the lessons, the introduction varies in content among grade levels. For example, the Wetland Spies (third grade) introduction is on the Animal Kingdom and the concept of habitat.

For the majority of the visit, students rotate through three topic stations, 45 minutes in length. Each station has two parts, a conceptual lesson introducing students to a new concept, and a hands-on activity applying student conceptual knowledge to the resources of the site. Sub-themes organize the content of individual stations. For example, Wetland Spies investigate the concept of food chains and adaptations of wetland water creatures.

All grades do the same closing activity (20 minutes) a solo journey which works toward accomplishing awareness objectives. After reading a story, My Own Secret Place by Byrd Baylor, to focus student attention, students go on a guided solo journey to creatively reflect on their field experience. Students have a choice between three sensory awareness activities: a sound map, a micro hike and color poetry. Students are given an activity choice to accommodate for diversity in learning styles and student interests. The closing activity has students reflect on personal connections to wetlands. The refuge field experience makes the most of a short outdoor experience through a station format. This format divides many students into manageable numbers (10-15), it allows students to experience a variety of concepts with an underlying theme, and it incorporates two EPM awareness and knowledge goals.

A 1-hour classroom visit comprises the EPM post-field component, which unites the entire experience and addresses environmental ethic and action EPM goals by reviewing field content and applying field learning to a relevant conservation problem.

Using a concept map approach (31, 12), the class reviews and visually organizes knowledge and content learned during the pre-site and field components of the program. Students then use the review to guide them through a problem solving exercise. Problem-based learning embodies two foundation concepts of the EPM: constructivism and inquiry-based learning. To be problem based, it is suggested three features be present: learning must be initiated with a problem, the problem must be ill defined, and the teacher must act as a “thinking” coach (6). At the beginning of a unit of study, students are presented with a problem, and all learning from that point on is directed toward gathering information and understanding the introduced problem. Ill-defined problems, or problems with no clear answers, are more realistic to science and environmental problems, and allow students to explore many interests and many fields to collect information. The teacher, acting as coach or facilitator versus all knowing resource, encourages students to direct questions to outside sources or internally, increasing critical thinking skills (8).

The EPM post-field component presents students with a relevant conservation problem, divides students into cooperative learning groups and challenges them to use learned knowledge and skills to draft a solution in the form of a plan. Teaching methods were drawn from Talents Unlimited, a thinking skills curriculum that helps students improve thinking skills in decision making, planning, communication, productive thinking, and forecasting (9).

In fifth grade, students are presented with the problem: drought is causing the BRMBR to lose much of its water. As a water manager you must decide which one of the five water units you are going to continue to maintain. After researching what each unit contains, small cooperative groups chose from their five alternatives using class drafted

criteria questions. They choose one alternative and list many reasons for their decision. They create a poster justifying their alternative and a plan to implement it.

Lesson Objectives and Activities

The EPM goals and structure then guided the development of lesson objectives and activities (See Appendix: Individual Lesson Plans). Objectives for each lesson were drafted using objective definitions outlined by Judy Eby (4), and learning outcomes outlined in the Engleson and Yockers environmental education model (5). Lesson objectives guided the placement of activities into the pre-field, field, and post-field experiences. Activities were drawn and adapted from various EE activity guides (Appendix A) and created by Utah State University (USU) collaborators. Compiled activities were categorized into similar topics, age groups, and pre-, field, and post-lessons. Program collaborators filled gaps by creating and adapting activities. (See Appendix D for activities and lesson objectives.)

The structure and elements of the EPM lesson plans address program goals as well as variable volunteer expertise. The draft lesson plans include a guide, student objectives, materials, background information, preparation, procedure and associated teacher talk, student assessment and visual aids. These features provide a well-informed, thorough lesson plan for inexperienced volunteers.

The guide box organizes and summarizes pertinent information about the lesson plan. It includes an activities overview, relevant core curriculum ties, thinking skills materials, and lesson references. Teachers can look at the lesson and see immediately what standards are being covered, or a volunteer can refer to this section to check materials. A focused background section gives instructors with variable experience the

necessary conceptual knowledge and BRMBR context to teach field lessons. Interwoven teacher talk provides questioning strategies and simplified explanations of ecological concepts for volunteers. Formal and informal assessments are presented throughout each lesson to give instructors ways to assess student comprehension. Diagrams and photos are found in the right hand margin with visual explanations of activities.

EPM Pilot Program

The EPM Pilot Program occurred in the spring of 2002 (April- May). Two Box Elder County elementary schools participated, Lakeview Elementary and Foothill Elementary. All third-fifth grades (9 classes) at Lakeview Elementary and all third graders from Foothill Elementary (3 classes) participated. Twelve teachers and 264 students were involved in the EPM pilot.

Lakeview pre-field sessions occurred on the last two Mondays in April and the first Monday in May, 2002. On each visit, one third, fourth and fifth grade class was taught. The lessons, 1-hour long, were taught in succession starting at 9:00 am. Each class received a discovery drawer set for 1 week. The Foothill pre-field sessions occurred on May 13. Three third grade classes were visited for 45 minutes each. One class, Noreen John's, received the discovery drawers for 2 weeks preceding the field trip. The other two third grade classes did not do the discovery drawer component.

Lakeview field sessions occurred on May 8 (third grade) and May 10th (fourth and fifth grade). The Foothill third grade field session was on May 24, 2002. All field lessons were conducted at the BRMBR headquarters, located 17 miles west of Brigham City. During each field session, three classes (entire grade) visited the refuge. Classes were divided into two field groups of 10-15 students. At least one teacher or parent

accompanied a field group throughout the day. Six post-site lessons occurred at Lakeview, on May 13th and 17th lasting 30- 45 minutes each.

Evaluation

Pilot program data provided feedback to improve teaching methods as well as intended goal and objectives of the EPM. The EPM evaluation included teachers, students, volunteer instructors, USU collaborators and coordinator observations. One or two levels of Kilpatrick's Evaluation Framework were included in each portion of EPM evaluation (3):

Reaction (Level 1) Did the trainees [teachers and students] like the program and feel it was useful? At this level, the focus is on trainees' perceptions about the program and its effectiveness.

Learning (Level 2) Did the trainees [students] learn what the objectives said they should learn. Measuring whether someone learned something in training may involve a quiz or test.

Teacher feedback assessed both teacher and student reactions and student learning. Feedback was obtained through on-going informal observations, and a teacher post-program evaluation. Informal feedback was obtained when the project coordinator conversed with individual teachers, and recorded comments in a journal. The final teacher evaluation was a survey asking a series of questions about each component of the EPM (See Appendix B). Nine Lakeview teachers were given evaluation forms and six returned them. Of the six returned, three were from the fourth grade, two were from the fifth grade, and one was from the third grade. No formal evaluations were filled out by Foothill teachers.

Volunteer EPM feedback assessed the student reactions and learning during the field component, yet the evaluation vehicle differed with each volunteer group. Pre-

service teachers wrote a two-page reflection of their field experience, answering the following questions: What would you change about the lesson you taught? What did you like about the lesson you taught? And, what did you learn from the Bear River Refuge field teaching experience? The Utah Conservation Corps volunteers completed a post-program evaluation, asking them to describe what worked and didn't work in the program (See Appendix B). Foothill Elementary School parent volunteers participated in a 15-minute debriefing discussion about their field experience.

Lakeview student learning was formally evaluated using a pre- and post- test method. The Lakeview Elementary School pre-test was administered at the beginning of the pre-field session, and the post-test was administered at the end of the post-field session. One third grade, three fourth grades and two fifth grades participated in the pre-/post- test. The pre-/post-test was an interactive quiz using items students would encounter during the EPM. Items varied from one grade to another, reflecting the content of the three programs. Ten to twelve items were brought into the classroom, and students were asked to answer two questions about each item. What is it, and why it is important? Students were given the same set of items for the pre- and post-test. Student answers were compiled and compared to see a change in awareness and sophistication in identifying and writing about the importance of each item (See Appendix C).

Student journals were used to evaluate the discovery drawer approach. As students worked through discovery drawers and field stations, they completed journal entries guided by the instructor or discovery drawer directions. Journal responses to activities were tallied based on whether journals contained the expected response, the incorrect response or no response at all. The percentage of expected answers indicated

how clear and age appropriate the drawer activities were. If students did not understand the activity or were confused by the directions, they would have recorded an incorrect response or no response. Percentage of no answers may also indicate that students did not have enough time to work on each drawer or teachers did not emphasize the use of journals or completion of the discovery drawers in their classroom.

Student learning and reaction feedback was also obtained through coordinator observations and reflections after teaching the pre-/post-field components and observing the field components. Videotapes also aided in reviewing student reaction and learning to pre-field lessons. Videotaped and teaching reflections were recorded in a journal kept by the program coordinator.

Volunteer Instructor Module

The volunteer instructor module (VIM) includes a volunteer recruitment protocol and a versatile, volunteer training program for the WWFEP. Volunteer groups were contacted, a training program developed and piloted, and volunteer experience was evaluated to revise the VIM.

Training Design

Volunteer training was developed using a Human Resource Training and Development Model (3). The model was adapted to fit the specific needs of volunteers, but in general the training followed the model. The goal was to train volunteers to teach EPM field experiences. To accomplish this goal, the training had to meet the following criteria:

- Familiarize trainees in the mission of the BRMBR and the WWFEP,

- Introduce volunteers to outdoor teaching and student management,
- Give trainees enough background information to confidently teach the field lessons,
- Familiarize trainees with lessons and field materials, and,
- Provide a supportive, non-threatening environment to practice new skills.

These criteria initiated the design of a volunteer instructor training program.

Design concerns incorporated a variety of teaching methods and flexibility in location and length of training sessions. Ideally, a volunteer training would be at least a 4-hour event and include a trip to the teaching sites, and multiple practice sessions. Volunteer availability and profiles played a large role in shaping the design of the training.

The training/teaching methods paralleled teaching methods used in the student field experience. This modeling gave volunteers an additional opportunity to see the teaching methods they would be using. Good teaching methods included: interactive mini-lessons and discussion with visual aids, cooperative learning groups, experiential learning, trainee presentations, synthesis of materials and a written assessment, all methods similar to those used with students in the EPM.

The sequence of the training began with an introduction to the refuge and WWFEP structure using a visual-aided lecture and interactive cooperative learning activity. Then trainees explored their roles as WWFEP instructors through a concept attainment activity. Next, a visual-aided lecture introduced trainees to the field day (preparation time, logistics and schedule). Trainees then chose teaching stations and were given time to read their lessons. Ideally, at least two trainees would be assigned to each station, meaning each trainee would be charged with teaching the entire station to one

field group or half a class. The stations were flexible enough to allow two trainees to team up to teach an entire class.

In their station groups, trainees did a cooperative learning activity where each group member read through the lesson with a different focus. The focus areas, assessment, materials, content, and management, guided a group discussion afterward. For example, one group member read through the lesson plan, highlighting materials used, and matching listed lesson materials with the materials field pack.

After the group has had a chance to discuss their results of the focus areas, trainees created individual teaching plans, putting the words and activities of the formal lesson plan into an outline to follow on the day of the field trip. This teaching plan serves as an assessment for the trainer to evaluate trainees' understanding of field lessons.

The next portion of the training is a synthesis exercise relating stations to the field day's theme. Trainees report results of the cooperative learning exercise, as the trainer outlines their responses on the board. The trainer leads a discussion to connect all the group's learning and to teach the importance of student learning synthesis. One discussion question is: How would you introduce the concept of food chains knowing students came from the bird station where they were learning bird adaptations? This synthesis gets trainees thinking about creating a cohesive learning experience for students.

Then, trainees return to their teaching plans and write two problems or issues that may arise, and they make teaching plan improvements to solve the issues. To reinforce training, trainees received a packet including: additional background information, outdoor teaching tips, a map of teaching site, a field trip schedule and a program evaluation form.

The VIM training incorporates a number of delivery methods mirroring student field experience. The training also allows trainees to explore materials and concepts they would be teaching, and then the training has trainees synthesize their learning by making connections to the big conceptual and logistical picture (See Appendix E for Training Teaching Materials).

Volunteer Profiles

Three unique volunteer groups were available for the pilot test: Utah Conservation Corps (UCC), USU pre-service teachers, and Foothill Elementary School third grade parents. The UCC is a non-profit organization supported by federal Americorps funds. Volunteers commit for 3-9 months to work on a range of conservation projects from habitat restoration to environmental education. The typical UCC volunteer is 19-30 years old, a college student or recent graduate. Volunteers have backgrounds ranging from English to biology. The UCC volunteers have variable teaching experience, ranging from outdoor educators to no teaching experience. Because of the conservation minded mission of the UCC, volunteers tend to be aware of conservation issues and knowledgeable about ecological concepts.

Utah State University pre-service primary school teachers participated in the WWFEP through Dr. Leigh Monhardt's Science Methods course. As teachers in training, these volunteers had some educational experience, but few had any actual teaching experience. Only one had experience teaching in an outdoor setting. Most lacked knowledge of the BRMBR, its conservation objectives or related ecological concepts.

Parents of Foothill Elementary School third grader comprised the last group of volunteers. Although they live in proximity to the refuge, the average Brigham City adult knows very little about the refuge, its natural resources or conservation objectives. These parents also had very little education experience, but they were excited and willing to learn.

VIM Pilot Program

The training sessions varied in length from 1 ½ to 2 ½ hours, based on volunteer availability. Trainee numbers varied from 6 to 27 per training. Three training programs were conducted on May 2nd, 6th and 15th. On May 2nd, six UCC volunteers were trained by the Refuge Field Coordinator to teach the Wetland Spies (third grade) field experience. Training sessions lasted 1 ¼ hours and occurred at the UCC office, USU campus, Logan, Utah.

On May 6, 23 USU pre-service teachers were trained by Kristen Gilbert and Dr. Leigh Monhardt. The introduction, led by Kristen with assistance from Dr. Monhardt, was done with all 23 students. Trainees chose field station topics and were divided into two groups. Eleven trainees, led by Dr. Monhardt, received the Wetland Investigators (fourth grade) field experience training. Twelve trainees, led by Kristen, received the Wetland Experts (fifth grade) field experience training. The training session was 1 ½ hours long, in the Eccles Education Building at USU.

On May 15, four parents and two teachers were trained in the Wetland Spies (third grade) field experience by Kristen Gilbert. This training was 1 ½ hours long and occurred in the library at Foothill Elementary School.

Evaluation

The VIM training was not formally evaluated, but informal observations were recorded on trainee perceptions and learning. Informal observations from interactions with trainees were recorded in a journal kept by Kristen Gilbert, program coordinator. The journal outlines how training sessions went, conversations with trainees on effectiveness of training, and trainees' questions and personal reflections on teaching methods and training sessions.

Formal EPM evaluations were also used to revise the VIM training. Volunteer evaluation questions were directed at improving the content and logistics of the EPM, but some volunteer comments reflected challenges and possible improvements in the VIM.

Results and Discussion

The pilot VIM and EPM modules surfaced a number of important issues for final program revision, but overall, the design and implementation of the WWFEP went remarkably well. No major shortfalls in materials or content were noted, 90% percent of responses on post-program evaluations were positive, and the weather somewhat cooperated for field experiences. Partner feedback, evaluations and personal observations, contributed to improvements in the final WWFEP.

Education Program Module

Teacher and volunteer evaluations, student assessment, and coordinator observations indicate the success of the EPM. More than 95% of teachers' evaluation comments were positive. Student assessment indicated that three of four program goals were met. Finally, volunteer instructors felt confident and adept at delivering the field experience, based on coordinator observations and volunteer evaluations, although there

is room for improvement. By looking at each component, pre-field, field and post-field, comments can be made regarding each component's strengths and weaknesses, and improvements for the final EPM.

Pre-Field Component

The pre-field objective was to engage and prepare students for the BRMBR field experience (see page 31) and introduce students to EPM goals and associated objectives. Student journals, Field Experience Coordinator journal observations and teacher feedback indicated that this objective was met. In pre-field student assessments, students correctly identified the five roles of a Wetland Spy/ Investigator/ Expert that correlate with the four EPM goals. Sixty-nine percent of the student journals show they correctly completed pre-field discovery drawers. Volunteers and the program coordinator recorded observations indicating student interest as a result of discovery drawers.

The pre-field session, The Introduction to the Refuge, was evaluated by first-hand and videotape observations. Videotape observations and student oral responses indicate that seven of the nine classes were engaged in the lesson. In seven classes, students were faced toward the speaker, responded quickly to questions, and answered assessment questions correctly. Videotape and personal observations indicate students seemed disinterested in a Lakeview third grade and fifth grade. Five to ten kids were not facing the speaker, only three to five raised their hands to answer questions, and only 40% of assessment questions were answered correctly. This might be attributed to poor classroom management or general class personality. To involve disinterested and unmotivated students, the final pre-field lessons will outline teaching strategies such as: giving uninvolved students special group tasks, calling on students who are not raising

their hands, and creating a physical learning environment that does not exclude any students (10).

To obtain a useful activity for students, two presentation formats were tested for the student presentations. Half of the third- fifth grade students were asked to report on a *series of questions* related to a cooperative learning activity. The second half were asked to *fill in blanks* related to the cooperative learning activity. Students accomplished the cooperative learning activity more quickly using the question/answer format, but had a harder time concisely presenting their results; whereas, students who used the fill-in-the-blank format took longer completing the cooperative learning activity, but more concisely presented their results. The final product incorporates both formats in the final activity, by building from question and answer to fill-in-the-blank.

Program coordinator observations and student written and oral responses indicate portions of the introduction used unfamiliar learning strategies, specifically, cooperative learning groups and certain map exercises. Two of the six, third grade classes had a hard time working in cooperative groups and understanding the geography concepts of continent, country, state, and landmarks. With instructor guidance, students were able to work in cooperative groups and understand the geographical concepts. The final program offers instructors formal guidance on how to insure third graders understand geography concepts and how to help them work in cooperative groups.

Logistically, with the inclusion of the pre-test in the introduction, an hour was not enough time to complete all the activities. All teachers responding to post-program evaluations thought the pre-/post- test was an important component. The pre-/post- test will become an optional pre-site activity implemented by teachers ahead of time to give

more class time to material that requires refuge staff expertise. Pre-site sessions scheduled one after the other diminished the quality of programs. With no preparation time, the refuge instructor was not as mentally or physically prepared to instruct. Also, if previous sessions went over time, the following session had to be cut short, decreasing the time spent on individual activities. To provide quality pre-site lessons, preparation time is essential. The final program allows at least 10 minutes between sessions.

Based on responses from teacher evaluations and interviews, discovery drawers were implemented in three ways. Two teachers allowed students to work individually on one drawer per day at the student's leisure or alphabetically by student's name. One class did the drawers in groups of four or five during a designated science period. Three teachers divided students into groups of three or four and let them work on the drawers throughout the day. Class times allotted for discovery drawers ranged from 20 minutes to 1 hour per day. These findings indicate the need for flexibility and variety when using discovery drawers (14). The final EPM includes a variety of options for using discovery drawers in classes (See Appendix D).

Teacher evaluations and student discovery journals indicate a need for a few improvements for the discovery drawer approach, but overall the discovery drawers were favorable received. According to teacher evaluations, some discovery drawers varied in student completion time. The fifth grade Artist Drawer took longer to complete than the other fifth grade drawers. The third grade Artist Drawer and fourth grade Steward Drawer were completed more quickly compared to the other drawers. These discovery drawers have been lengthened or shortened to accommodate these time discrepancies. For example, the final version of the fifth grade Artist Drawer eliminates time spent

drawing a map by doing a less time consuming art activity related to transforming two dimensional maps into three dimensional scenery sketches. A coloring step has been added to the third grade Artist Drawer to lengthen it.

Discovery drawer instructions, teacher participation, and student interest were evaluated with student discovery drawer journal responses. Table 2 describes the percentages of each grade with expected, incorrect and no journal answers. The highest percentages (76 and 77%, respectively) of expected answers in the fourth and fifth grade indicate that discovery drawer instructions were understood and followed. Discovery drawer individual entries that had unusually high no response or wrong response percentages across classes were eliminated or modified. For example, third and fourth grade students, after playing partner games, were asked to write how they played hard, fair, and safe in their journal. An overwhelming 88% of students did not have a response to this portion of the Communicator Discovery Drawer. The final version of the discovery drawers eliminates this question, yet incorporates the teamwork concept into other journal entries associated with the drawer.

Table 2. Percentage of expected/incorrect/ no answer discovery drawer journal responses for third through fifth grade.

Grade Level	Correct Answers Recorded	Incorrect Answer Recorded	No Answer Recorded
3 rd Grade	54%	5%	41%
4 th Grade	76%	2%	22%
5 th Grade	77%	6%	17%

The lowest percentage (54%) for expected answers and the highest percentage for no answers (41%) for the third grade indicates that the number of required written responses may be too high for this age group, or that not enough time was allowed to complete each drawer. Increasing teacher direction and incorporating other types of responses (drawn, acted for teacher, sign off from partner) may mitigate this problem.

Teacher support for discovery drawers, based on the percentage of completed journals per class, was consistent except for one fifth grade class. Three third, three fourth, and two fifth grade teachers returned over 95% completed journals. One fifth grade class returned less than 50% completed journals. This may correlate with four out of six USU pre-service teaching teams mentioning the lack of student preparedness and focus during the field experience in this fifth grade class compared to the other two fifth grade classes. Without proper preparation and follow-up, students can be overwhelmed or uneasy during a field experience and not be receptive to new information (19).

With regard to the discovery drawers, teachers made minor editorial and implementation suggestions (See Appendix B for teacher evaluation responses). Teachers were asked the following evaluation questions for each discovery drawer:

- Did your students enjoy this activity?
- Did this activity have educational value?
- Was the activity well organized?
- Did this activity relate to the core curriculum?
- Should we keep this activity?

The one Lakeview third grade teacher responding to the post-program evaluation mentioned that instructions for the blind drawing in the Artist Discovery Drawer were confusing. These instructions have been clarified. The third grade teacher also mentioned that her students did not enjoy the Steward Discovery Drawer. She said they were concerned and stressed about thinking of 21 ways to help wetlands, and this concern was reflected in 40% no answer responses on this journal question. For the final version of the Steward Discovery Drawer the instructions ask for at least 10 ways to help wetlands.

All three Lakeview fourth grade teachers turned in post-program evaluations. One teacher answered 'yes' (positive) to all discovery drawer questions. Two teachers had concerns about the Steward Discovery Drawer. One thought only 'some' of the steward activities were enjoyed by her students, but the activity should be kept and expanded. Another teacher responded that this discovery drawer should not be kept, because students did not enjoy it, and it was not well organized. The activity was a decision making activity that essentially had a pre-determined answer and students were not given the freedom to think critically. The final version of the fourth grade Steward Discovery Drawer will include activities more closely related to wetland conservation and less contrived.

Two fifth grade teachers responded to the evaluations and 41 of 50 responses to discovery drawer questions were 'yes' (positive). One teacher thought the Artist Drawer did not have educational value, and should not be kept. One personal note on this comment, her class received the drawers the second week after most the drawer's contents had been eliminated because of time and material constraints. This teacher also mentioned that her students did not enjoy the Steward Discovery Drawer, but that it

should be kept. She also mentioned that the Scientist and Explorer Drawers were not well organized, but only the Explorer Drawer should be eliminated. The other teacher responded 'OK' to his students enjoying the Artist and Communicator Drawers, and the artists only reached 'some' of the core curriculum. He responded positively to the rest of the questions concerning the Artist and Communicator Drawers. He also mentioned that his students 'very much' enjoyed the Scientist Discovery Drawer. The number of affirmative evaluation responses and above mentioned, positive comments indicate that, overall, teachers were pleased with the Discovery Drawers.

Other teacher comments highlighted minor editorial and logistical problems. One fourth grade teacher wrote, "fourth grade journal references did not correlate with correct journal pages". Two requested more drawer materials or additional drawers so more students could work on drawers at the same time. The discovery drawers will stay the same with some minor grammatical and organizational changes to reflect teacher suggestions. There are some larger content issues with the Steward Discovery Drawers, and these were addressed by reevaluating the objectives of these activities and using new activities (See Appendix D for discovery drawer instructions).

Field Component

Student pre/post assessment, teacher evaluations and student observations indicate that the pilot field component achieved two of the three program knowledge objectives and one of the two awareness or affective program objectives. To accomplish other objectives, the final EPM incorporates more affective/awareness activities and addresses the evaluation of affective objectives. The final EPM also refines activities meant to achieve knowledge objectives.

Student post-test responses to the ‘What is it?’ questions showed a clear change in sophistication and awareness (see Appendix C for pre-/post-test responses), indicating that identification and classification knowledge objectives were met. For fourth grade, the most striking changes related to the test items: wetland mud, tamarisk, and a Western Grebe photo. On the pre-test, the most common responses to the ‘What is it?’ questions for these items was: *mud*, *stick* and *picture*, respectively. On the post-test, the most common responses were: *mud*, but with new terms like *clay* and *soil*, *tamarisk* and *woody plant*, and *Western Grebe*, showing a distinct shift in correct and more specific answers based on what was learned in the EPM field component.

Such striking results were not seen in fifth grade identification responses, but a few changes were noted in fifth grade responses to the question, ‘Why is it important?’. For instance, when fifth graders responded to a picture of a flock of birds, the most common pre-test and post- test identification answer was a *flock of birds*. The most common pre-test importance answers were *unknown* and *to help nature*. The most common post-test importance answers were *for their part in the food chain* and *so biologists can count how many there are*, indicating that the bird lesson on estimating populations was retained by students.

No third grade post-test quizzes were given, hence no comparisons could be made with post-tests. Besides noted fifth grade responses, no other ‘Importance’ responses changed from pre to post test. This may be due to a couple of issues: inconsistent pre-/post- test administration, non-relevant test items, test format, or the EPM did not emphasize the importance of the wetland test items.

The number of students per class varied, resulting in different numbers and types of quiz items in each classroom, preventing the compilation of all responses per grade level. Only similar items used across classrooms could be compiled to make school-wide conclusions about the effectiveness of the EPM in reaching knowledge objectives. Because test items were chosen before the field program was developed, some items were irrelevant. For example, the fifth grade program originally included an activity called Wetland Metaphors. This activity teaches the various functions of wetlands by using household items as metaphors for wetland functions. A sponge was included in the pre-/post-test, but the final pilot EPM did not include this activity, and students wrote the same responses for identification and importance on the pre- and post- test.

Pre-/post- test design problems aside, the results may indicate a larger program weakness. Students' pre-/post-test responses indicate that the pilot EPM emphasized identification but not larger ecological connections or human influences. The final EPM attempts to better balance *identification* and *importance* in all components. This balance is highlighted in the following student knowledge objective under EPM knowledge goal: Students will be able to give one example of how an ecological concept relates to something we saw on our field trip. For example, in third grade, students would be able to explain why shorebirds have the adaptation of long beaks and long legs. Final field activities will also more clearly reflect importance objectives. For example, lesson plans will guide instructors to ask students more *why* questions and provide background to support ecological connections.

The pre-/post-test was an important tool for student knowledge assessment, and should be included in the final program. Improvements in the administration of the tests

include: having students record answers about the same item at the same time, instead of passing items. This limits the interactive nature of the test, but insures more consistent and readable responses. For the final program, relevant test items can be chosen. A matrix of expected answers should have been created before the test was administered, facilitating a clear connection between the content tested and the content taught in the EPM.

Literature suggests that students are positively affected by field trips. For example, students who participated in a marine ecology field trip showed a more positive attitude toward the subject matter following the experience (13). In environmental education programs, this positive, affective field experience reinforces awareness and affective objectives which correlate with a model for environmental literacy (5).

Although EPM goals had an awareness/affective component, affective lessons were not fully implemented or evaluated. Affective objectives were not clearly evaluated by teachers or volunteers, and activities directed toward achieving these objectives were not tested. Observations of students recorded in the program coordinator's journal indicate a few attitudes may have been negatively affected because of environmental variables, weather and insects, and the rigid program structure.

Questions on the teacher post-program evaluations asked if students enjoyed individual activities, but no question asked teachers to indicate a greater student awareness or positive attitude change toward wetlands or the BRMBR. Volunteers reflected only on their own experience, not the affective development of students. Hence, both adult evaluations were unable to determine whether affective objectives were

achieved. Student activities directed toward affective objectives were eliminated due to time constraints. For example, the closing story and associated reflective walk were cut.

Final program volunteer and teacher evaluations will attempt to address affective objectives by including questions which have volunteers and teachers reflect on affective objectives. The final program will also incorporate elements of the affective closing activity into a exploration/orientation walk at the beginning of the day. Affective elements of the orientation walk will give students an opportunity at the beginning of the day to make personal connections and then move on to the more knowledge-driven portion of the field day.

Research shows that motivating students, and improving the quality of social interactions factor into achieving affective objectives at non-formal science education centers (15). Observations indicate that students were very excited to participate in the field program (motivation), but attitudes might have been negatively affected by weather and program structure (diversity, social interactions). For all field trips, the weather was rather cool, and students and teachers were concerned about getting shelter from the weather for at least part of the day. Future programs should emphasize student comfort and alternate plans for cold weather. With the construction of the education center, accommodating student comfort should be much easier. Observed student attitudes and informal comments by teachers indicate that the EPM structure was too rigid, especially the fifth grade program. Students were not given enough freedom to explore the site. The addition of an orientation walk attempts to break up the rigid structure into a guided exploration and allow more social interaction with teachers and peers.

Through evaluations, teachers and volunteers made both content and structural suggestions for the final EPM program (Appendix B). The UCC volunteers focused on content changes, while USU pre-service teachers remarked about both content and structural changes, and participating teachers remarked mainly about structural changes.

The UCC volunteers teaching the Wetland Spy program remarked that some of the Water Spy content was too sophisticated, particularly the information specifically about carnivores, omnivores, and herbivores. In contrast, the parents who taught the Foothill Elementary Wetland Spy field experience remarked that students did not have a problem understanding the more sophisticated concepts, based on their completion of the activities. These results show that variation can occur among schools, and lessons should reflect variable student backgrounds. Final lessons will shift knowledge-driven lectures to more inquiry-based approaches, allowing students to work at their own pace and level through the concepts of the lesson. For example, third grade Water Spies will investigate the concept of food chains through their own exploration, versus being introduced verbally to concept in the beginning.

The USU pre-service teachers taught the Wetland Investigator and Wetland Expert field programs, and mentioned in their post-experience reflections that some changes were needed in content and structure. They found the name tags and pre-division of groups very helpful for teaching the field lessons. They were concerned about the fast paced nature of the field day, and mentioned cutting back on the content of the lessons in order to have more time for exploration at each station. Content-wise, they mentioned that the fourth grade soils station had less teaching material than the other stations and that more needs to be done to fill the allotted time.

Teachers' comments principally focused on structural changes. Three out of the six teachers responding to post-program evaluations thought two activities (Introduction at School and Introduction at Refuge) should be eliminated from the WWFEP, because students did not enjoy these activities. These activities were eliminated from the final EPM because students had a hard time moving from one very structured activity to the next, and while at school they were very excited to be out in the field, not sitting at the school. The goals for the in-school introduction (to review discovery drawers, and to insure students have all field and comfort supplies) can be shifted to teacher preparation for the day. Changing the introduction at the refuge to a small group orientation walk should also mitigate the teacher concerns by breaking up the day's station --sit and wait-- structure.

Post Field Component

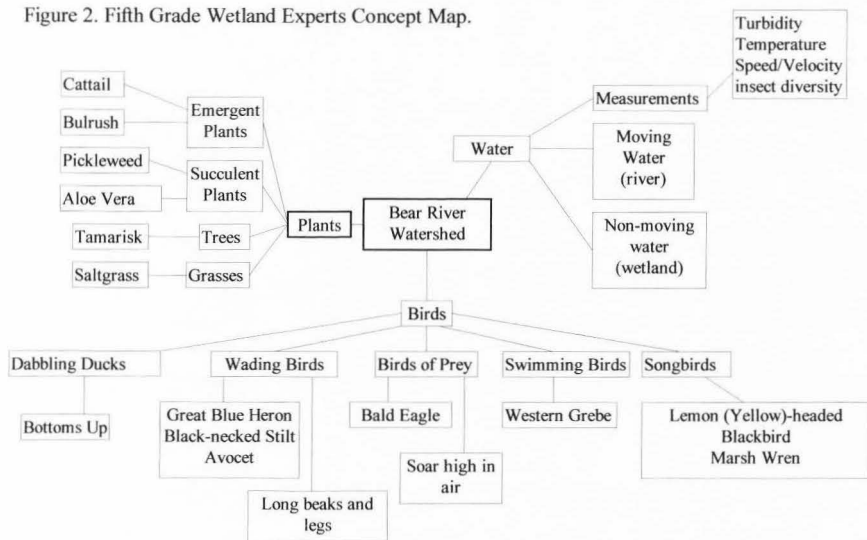
Post-field activities provide a context in the classroom to integrate field learning (19). This statement was reaffirmed by the students completion of mind maps during the limited implementation of post-field experiences. Six classes at Lakeview Elementary received a shortened post-field lesson, including a concept mapping activity and a Project WET activity called Pass the Jug. Two factors contributed to the shorten post-field lesson: Lakeview Elementary post-field visits were scheduled during end-of-year testing, meaning some teachers forgot about them or had to shorten them to finish testing, and the lessons were not fully developed. The pre-field/field components of the program took more time than planned, and little to no time was left to design and implement the post-field component.

The concept map was implemented in four classrooms and provided a useful assessment of the EPM (12), and student knowledge objectives. The concept map activity surveyed class acquisition of facts related to the field experience. Their verbal responses indicated that they had learned program vocabulary and could organize it into the categories. Figure 2 is an example of a fifth grade concept map. The concept map was a useful review and assessment tool and is included in the final EPM.

An adapted Project WET activity, Pass the Jug, was conducted in three classrooms, one third grade, and two fifth grades. Student responses indicated that students were unable to connect the activity to the field experience, and had a really hard time connecting the field experience to their own attitudes and behavior.

In this activity, each student received a small cup, and this was their allotted water use on the Bear River. As the Bear River (bottle of soda) flowed by them they could fill their cup. The first round, everyone gets an equal share of soda. The next round, every fourth person is assigned a role: rancher, industry or city. When the river passes by these students, they can take more than their share based on the needs of their industry. They also add things to the soda (pollutants). The activity illustrates possible water uses along the Bear River and how these uses affect all organisms downstream. Students were then asked to take one of these uses and describe how it might affect the BRMBR and then how they might lessen its impact.

Figure 2. Fifth Grade Wetland Experts Concept Map.



In the three classes this activity was taught, students were unable to write or say how these impacts affected the BRMBR, except by responding that the birds would get sick. They also could not connect their own water use and food consumption to water never reaching the refuge. These responses may be another indicator that the EPM failed to address importance and human connection objectives. Student responses may also be indicative of poor lesson planning, shorten time periods for post field lessons, or one classes' misbehavior on account of the teacher's absence.

As stated in the program design, a different post-field program was planned.

Unfortunately, the coordinator did not have time to adequately plan these lessons, hence the generic shorten lessons focused more on implementing the post-tests than investing time in the post- field problem solving activities. Ideally, a grade specific problem should

be presented after the concept map review. Students then should have been guided through the problem solving process and allowed to come up with plans for their solutions (8). The final EPM includes a general one-hour, post-field lesson, excluding the post-test. The post-test, like the pre-test will be an optional post-field activity for teachers to implement.

Volunteer Instructor Module

Volunteer reflections and EPM evaluations were useful tools to review the VIM. Lack of confidence with some of the volunteers seemed to be their biggest concern. Teaching ability and familiarity with content are two areas volunteers felt were important to instill confidence. To accomplish this, the training program works toward increasing volunteer confidence in background information and teaching techniques. Thirteen volunteers remarked about the need for more background information. According to volunteer reflections and evaluations, volunteers did not feel comfortable with the teaching content. They felt they would have benefited from additional background information in the training and lesson plans. Because of the draft nature of lesson plans, the plans did not contain extensive background information. The final EPM lesson plans include more comprehensive and relevant lesson background sections. Volunteers need to know both the ecological content they are teaching and a site context for the content. The background information included in the lesson plans includes how the lesson's ecological concepts relate to the BRMBR and the management goals of the refuge. General refuge information is also a component of the full training. Trainees do the same refuge introduction activity students do during the pre-field visit. This activity was eliminated from one training because of time constraints, and additional reading materials

were put in packets. It is obvious that the additional information was not read, and trainees needed an additional training exercise to learn refuge background information. The final VIM will require this introductory activity in order to increase trainee background knowledge and instill higher volunteer confidence in content.

Reflections and evaluations also indicate that teaching experience affected volunteer confidence. Volunteers who were able to adapt and improvise upon lesson plans had a more pleasant teaching experience and felt they conveyed lesson objectives more effectively. This was evident in USU pre-service reflections and UCC volunteer evaluations (Appendix B). Volunteers who had good student management skills were also more comfortable teaching. For example, volunteer instructors who used lesson plan management techniques (sitting in circle, wetlands code word) had an easier time working with the group. Observers noticed a striking difference in leaders who employed instructed management techniques and those who did not. Leaders who gathered students in a sitting circle had an easier time explaining activities and interacting with the group. Leaders who did not use the circle technique had to talk louder and refocus the group on various occasions. The final VIM reemphasizes management tips in the lesson plan, as well as instructs trainees on outdoor student management techniques.

The VIM, including volunteer training and evaluations, must instill volunteer confidence in order to deliver a quality environmental education program. The EPM is based on sound educational philosophies, and making volunteers aware of these philosophies instills confidence in the design of the program. In some respects, the pilot training failed to instill the major philosophical tenets of the program. One volunteer remarked in her two page reflection that her students were not asking questions, and so

she felt obsolete as an instructor. Comments like these indicate that the idea of inquiry-based learning had not been learned. In this situation, she imagined herself as the all knowing teacher who was merely there to provide answers to student questions. Two other volunteer instructors mentioned similar experiences. If all three of them would have had a better understanding of inquiry-based education they could have sparked student interest by asking their own questions and having students brainstorm ways in which to answer instructor questions and their own (7).

The final Volunteer Training includes an additional trainee activity which explores the program's educational philosophies in a way that reflects the meaning of each philosophy. For example, the inquiry-based learning approach could be modeled for trainees, and then they would have an opportunity to role play and use modeled questioning strategies. By increasing trainees' familiarity with educational philosophies, the final VIM attempts to instill volunteer confidence through better teaching techniques.

The VIM also set out to test the applicability of volunteer-taught refuge education programs in areas with lower populations and less school support for field trip and EE. At San Francisco Bay, programs are taught by volunteers recruited by teachers (24). Because of the demographic differences, additional volunteer pools were recruited to participate in the BRMBR education program.

The biggest challenge to using volunteer pools was volunteer availability. The USU pre-service teachers were available for only one day, which meant that two field trips had to be held on one day. This stretched available teaching materials and crowded teaching sites, possibly lessening the quality of the experience for both volunteers and students. It would be great to have these pre-service teachers participate in the field

program again, but they should not be depended on to teach more than two programs.

UCC volunteers were also available for one day, but this was due to the late recruitment and scheduling. This could be solved by coordinating UCC volunteer availability with scheduling field trips. By calling the UCC office and talking with coordinator, UCC volunteers may be able to volunteer for various field trips.

The most ideal and available volunteers were parents recruited by Foothill Elementary teachers. Similar to San Francisco Bay's program (24) the Foothill Elementary teachers recruited parent volunteers to be trained to teach the lesson. Foothill Elementary teachers approached the coordinator about scheduling a field trip to the BRMBR after Lakeview Elementary had been chosen for the pilot program. Because money was still available for buses, the coordinator offered the field trip on the condition that teachers recruit volunteers to teach the field experiences. Parent volunteers were as adept and effective at teaching the field lessons as other volunteers, based on similar field journal responses, and it was less of a refuge administrative burden.

Both teacher and refuge volunteer recruitment approaches are outlined in the final VIM. Including both approaches accommodates schools in which teachers may not be as invested in the program to recruit volunteers, and schools in which teachers are willing to participate at higher preparation cost (See Appendix E).

Conclusion

The WWFEP attempts to fulfill public education and management needs of the BRMBR, while providing expertise and much needed financial and organizational support to schools in the GSLE. The two pronged design of the WWFEP creates and implements an educationally and environmentally-based field experience for elementary students and

trains community members to teach it. As a result of the spring 2002 field tested the following can be concluded:

- The Discovery drawers were a effective pre-field activity to prepare and engage students in a field experience without taxing teacher expertise or time.
- Volunteer supported programming is feasible in the Brigham City and the Great Salt Lake Ecosystem.
- Knowledge objectives were covered in the EPM, but affective objectives related to awareness and action goals were not met.
- Confident volunteers make good field teachers.

The pre-field learning centers (discovery drawers) relieved teachers from the burden of pre-site lessons, while insuring students were prepared and excited for a field experience at the BRMBR. Seven out of 22 USU pre-service teachers' reflections also made unsolicited mentions of student preparedness, demonstrating that discovery drawers prepared students for refuge field experiences. One volunteer remarked, "Students were well prepared and referred back to their *favorite* discovery drawers during the field lessons, as well as responded promptly to review questions."

Another innovation of the VIM was successful using volunteers in a more sparsely populated area with little community support for environmental education or conservation programs. The volunteer pools (UCC, USU pre-service teachers, and Foothill parents) were easily recruited although their availability was a constraining factor. All three volunteer pools were equally confident in student management and teaching content, and overall confidence can be increased though increased emphasis on management tips and background knowledge in the final program. the volunteer training.

The pilot field component achieved EPM knowledge objectives, but failed to evaluate or fully reach affective objectives. The final EPM expands activities related to student knowledge and affective objectives, and assesses objectives via students, teachers and volunteers. The pilot also surfaced valuable feedback which illustrated gaps in program structure, content and evaluation methods. The final EPM fills gaps in content and shifts program structure from a rigid to a more flexible format.

The final VIM used volunteer evaluations and informal observations to revise the volunteer training and evaluation program. Confident volunteers had the best teaching experience and were the most proficient at conveying student objectives. The final VIM attempts to increase volunteer confidence in content and teaching ability. With extensive background information and in-training activities, volunteers will be exposed to a variety of content. By introducing the philosophical aspects of the EPM and practicing through various exercises, trainees will become more comfortable with teaching and managing students. Volunteer-taught refuge education programming can be done in lower populated and less supportive communities, based on the success of the VIM, although allowances do need to be made for differences in teacher support of an environmental education program.

Future Directions

The WWFEP is the first step in providing quality environmental education experiences at the BRMBR. Recommendations for future directions include:

- Field testing and elaborating post-field lesson plans,
- Expanding students assessment,
- Designing and implementing a program evaluation,

- Exploring volunteer retention,
- And expanding volunteer pools.

Because the post-field lesson was not field tested, the action component of the environmental education model was lacking in the pilot test of the WWFEP. The post-field final lesson should be field tested and fully incorporated in the field experience.

The post-field lesson is a key student assessment of the WWFEP, and should be part of expanding student assessment of the program. Expanded student assessment insures program goals and objectives are achieved hence student assessment should further include measures to evaluate all four major goals: awareness, knowledge, environmental ethic and action, currently assessment focuses on knowledge goals.

Facilitating reporting of student assessment should also be a future direction. Mini-student assessments are included in most lessons, a space on the volunteer evaluations could provide the opportunities for volunteers to report on student assessment of their particular lesson.

Program evaluation is another area to work on in the future. The final WWFEP does not include evaluation forms for teachers, volunteers, or refuge staff. Developing evaluation forms for all partners should be a future priority. Also a longitudinal evaluation of WWFEP could include a study of students who participate in the WWFEP for three consecutive grades. A program evaluation of this type could indicate how a wetlands education program effects students' future lifestyle choices: changes in their personal lives that positively effect wetlands, membership in environmental or wildlife clubs, or careers in conservation or wildlife related careers).

Volunteers are another area of continued opportunities and potential. The main

focus of the VIM was training, recruitment was limited and volunteer retention was not addressed at all. Recruitment can be addressed in the future by expanding volunteers pools and fully utilizing current pools. Parent volunteers were successful in the WWFEP as far as being able to teach the field lessons, expanding the use of parent volunteers should be a future priority. Weber State University and the Utah State Extension Education and Science classes could be approached to teach the program as a service learning opportunity. Partnerships with the Brigham City Senior Center, and the Boys and Girls Club could also be used as recruitment pools. Involving local high school students is another volunteer pool untouched by this project.

Once volunteers are recruited and trained, there is also the issue of retention. Returning volunteers reduces the time spent on recruiting and training new volunteers. A limited number of volunteer pools does exist in an area like Brigham City, so it is crucial to not keep moving to new volunteer pools for every program. Also more experienced volunteers are more effective teachers, so it is in the best interest of the program to pursue volunteer retention. Parents with children in more than one grade can be encouraged to volunteer for both field trips year after year. Hopefully, as more community members become aware of the BRMBR, more extensive interest may develop and they will want to volunteer for multiple field experiences. Another component of retention is recognition. After every program it is important to recognize volunteers they need to know they are appreciated and needed for the success of the program. This can be done verbally, with thank you cards, special recognition events (dinner, part, special field trip).

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Appendix A

Activity References

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Appendix B

Evaluation Forms

Evaluation Responses

UCC Evaluations

USU Pre-service Teachers Selected Reflection Responses.

USU Pre-service Teachers Selected Reflection Responses.

Kara Ogden-Fifth Grade Flying Census

We noticed as teachers that the children took more interest in looking at birds when we helped the name and identify the type of birds they were looking at. . . . The children were more focused on identifying the birds than counting them. In the lesson we spent more time then discussion the characteristics and classification of the birds than the actual estimating part.

Ami Beutler-Fifth Grade Flying Census

The bean activity was at the end of the lesson. By this point many students were restless and did not want to listen. I know that when I am in one place to long I act the same way and I just want to leave. I think we could improve this situation by keeping the participation level high. . . . Every kid can become an expert and can teach a friend about one bird. If this teaching of a friend were set up constructively, with a page in the workbook for the friend to sign, this would ensure everyone is involved and participating.

Andrea Hall- Fifth Grade Geography of Plants

I feel like the plant activity could have been more hands-on. We finally scrapped the original activity of classifying pictures and showed them the actual plants from different areas, such as emergent and scrubs.

Adrienne Hall- Fourth grade Winged Investigators

The only management issue we had that occurred because of working in an outdoor environment was with the first group. Two of the boys walked quite a way up the creek. I watched them until I was just a little alarmed at the distance. So I followed their trail with the intentions of asking them to come a little closer to the rest of the group. I changed my mind a bit once I reached them. As I watched as listened to their conversation, I could hear how excited they were to be discovering new things. . . .

Candice Hislop- fourth grade Wetland Plants

I felt somewhat inadequate teaching the lesson at first, as I was not familiar with all of the terms in the lesson, not an expert plant identifier, and had not had all the materials available for the lesson until the day of the activity. My partner may have experienced similar anxieties. Though I could not answer all of the students' questions or those of their teachers, with each lesson, the inadequacy lessened and we learned and made discoveries together.

Jocelyn Blakey- Fifth grade Geography of Plants

I can take my students all sorts of places, but taking them won't be motivation for all of them to learn and explore. Just as in the "Trip to the Zoo" article, pre-trip and post-trip activities will be motivation for my students to learn more.

Jan Hooley - Fourth grade Wetland Plants

Let's take a field trip! What a great learning environment for all involved teachers and students alike. I enjoyed jumping right into a teaching situation, learning about Wetlands both as a student and then as teacher.

Appendix C

4th and 5th grade pre/post test Responses

Fourth Grade Responses

Fifth Grade Responses

Fourth Grade Responses

Test Item	Most Common Pre-test Importance Response	Most Common Pre-test Importance Response	Most Common Pre-test ID Response	Most Common Post-Test ID Response
Cloud of Midges	unknown/build land	food for birds	a sand geyser	bugs, gnats, mosquitoes
Soil thermometer	To know temperature	To know soil temperature	thermometer	soil thermometer
Tamarisk	feed birds/nests	good for nothing/ suck up salt/ give oxygen	a stick	tamarisk, woody plant
Western Grebe	swims/ keep weeds low	keep fish levels low/it swims/	bird, loon	Western Grebe
wetland mud	keep nests together	keep nest together	mud	mud, soil, clay
salt grass	bird food/ nests	to eat it/nests	weed	grass, wheat
Refuge Boundary sign	tell you where you are	tell people where they are/protect birds and ducks	sign	sign
Great Blue Heron	nature	habitat	bird	bird/wading bird/long-necked bird
<u>Fifth grade Responses</u>				
Test Item	Most Common Pre-test Importance Response	Most Common Pre-test Importance Response	Most Common Pre-test ID Response	Most Common Post-Test ID Response
Western Grebe	to look at	eat fish	ducks	ducks
vegetation map of refuge	know where you are/ unknown	show area/finding plants	a blob, x-ray, art, map	map
dense flock on unidentifiable birds	unknown	check populations, to count	flock of birds	flock of birds
secchi disk	to do tests/ measuring stuff	How deep the water is	tester thing	turbidity measurer
Bulrush	things eat them	home, produce Oxygen	plants	emergent, cattail, plants
N. Pintail (duck)			duck	dabbling duck
Refuge Boundary Sign	to warn people	to tell people	sign	sign